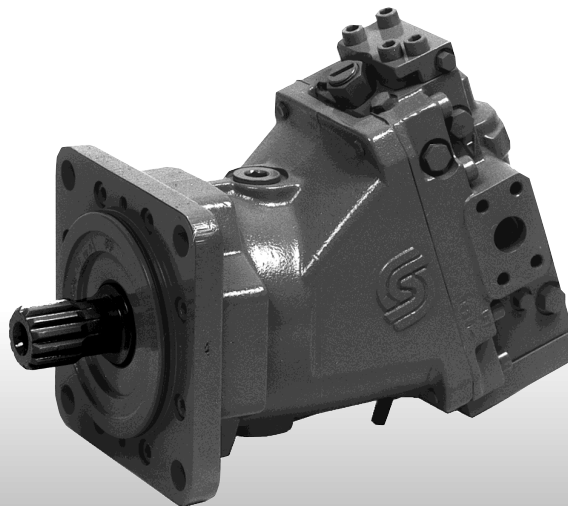




Series 51



Bent Axis

Variable Motors

Repair Instructions

Safety Precautions

- When Series 51 units are used in vehicular hydrostatic drive systems, the loss of hydrostatic driveline power in any mode (forward, reverse, or "neutral" mode) of operation may cause a loss of hydrostatic braking capacity. A braking system, redundant to the hydrostatic transmission must, therefore, be provided which is adequate to stop and hold the system should the condition develop.
- Certain service procedures may require the vehicle/machine to be disabled (wheels raised off the ground, work function disconnected, etc.) while performing them in order to prevent injury to the technician and bystanders.
- Use caution when dealing with hydraulic fluid under pressure. Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury. This fluid may also be hot enough to burn. Serious infection or reactions can develop if proper medical treatment is not administered immediately.
- Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Major Repair Instructions — General

CAUTION — DISCLAIMER OF LIABILITY

These repair instructions are provided for technicians who have been trained by Sauer-Sundstrand in the repair of Sauer-Sundstrand Series 51 motors. Sauer-Sundstrand recommends that any repairs be performed by Sauer-Sundstrand trained technicians. Sauer-Sundstrand expressly disclaims any liability for workmanship related failures resulting from repairs performed by any person using these instructions.

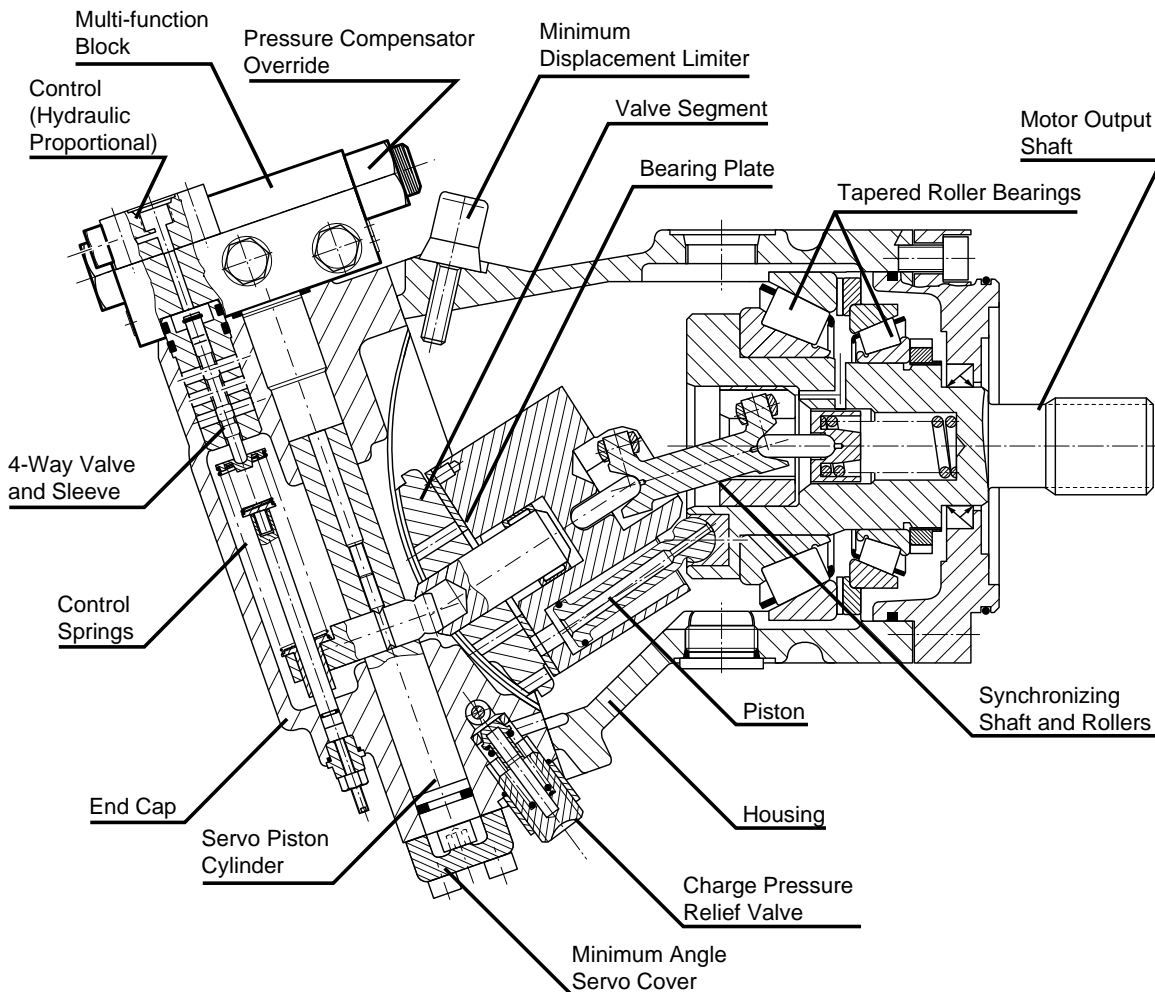
The procedures on the following pages are for the complete disassembly and reassembly (Major Repair) of the Series 51 Variable Displacement Motors.

Cleanliness is a primary means of assuring satisfactory hydraulic motor life, on either new or repaired units. Cleaning parts by using a clean solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material.

During the assembly of the Series 51 variable motor, all surfaces which have relative motion between parts should be coated with a film of clean hydraulic oil. This will assure that these surfaces will be lubricated during start-up.

It is recommended that all O-rings and gaskets be replaced. Lightly lubricate all O-rings with clean petroleum jelly prior to assembly. All gasket sealing surfaces must be cleaned prior to installing new gaskets.

Refer to the Series 51 Bent Axis Variable Displacement Motors Service Manual for further information.



Major Repair Instructions — Disassembly

1

Remove the control and multi-function block (if installed), 4-way valve spool and sleeve (if installed), control springs (if installed), and minimum angle servo cover from the motor. Refer to the Series 51 Service Manual for details.

Remove the screws (items G32 and G34) retaining the end cap assembly to the motor housing.

Remove the end cap assembly, gasket (item G60), and alignment pins (item B50).

Remove the internal motor parts as shown.

Note orientation of segment with end cap and housing.

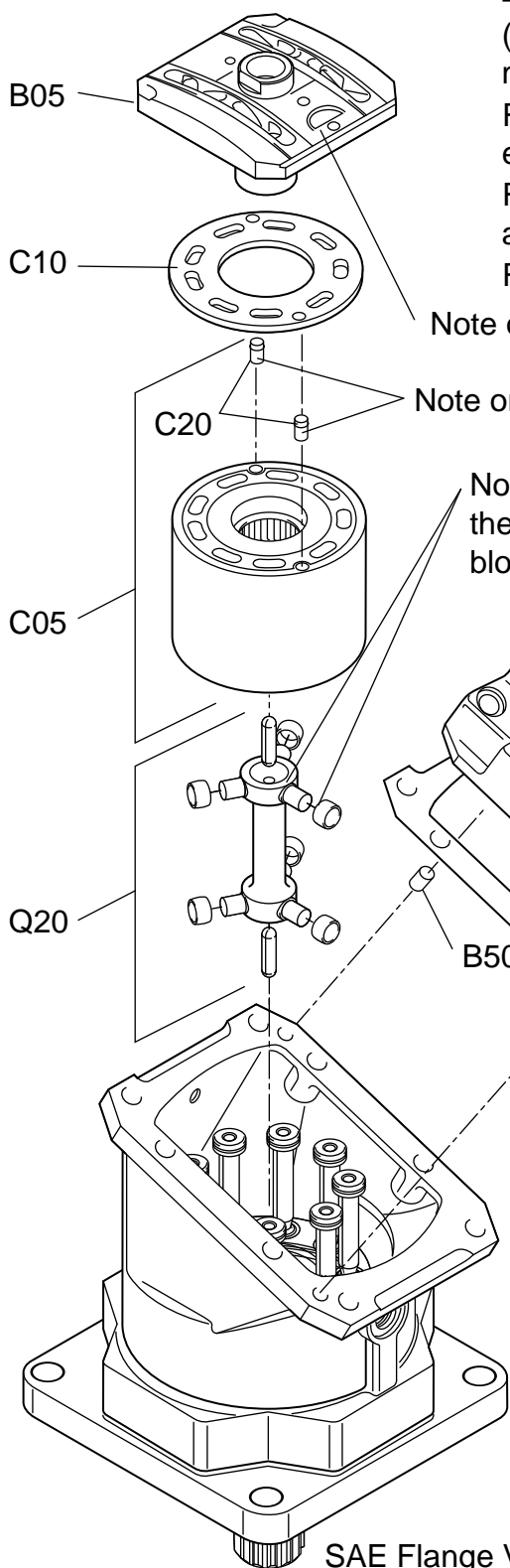
Note orientation of pins.

Note orientation of rollers with synchronizing shaft (recess faces the centerline of the shaft), and synchronizing shaft with cylinder block and output shaft.

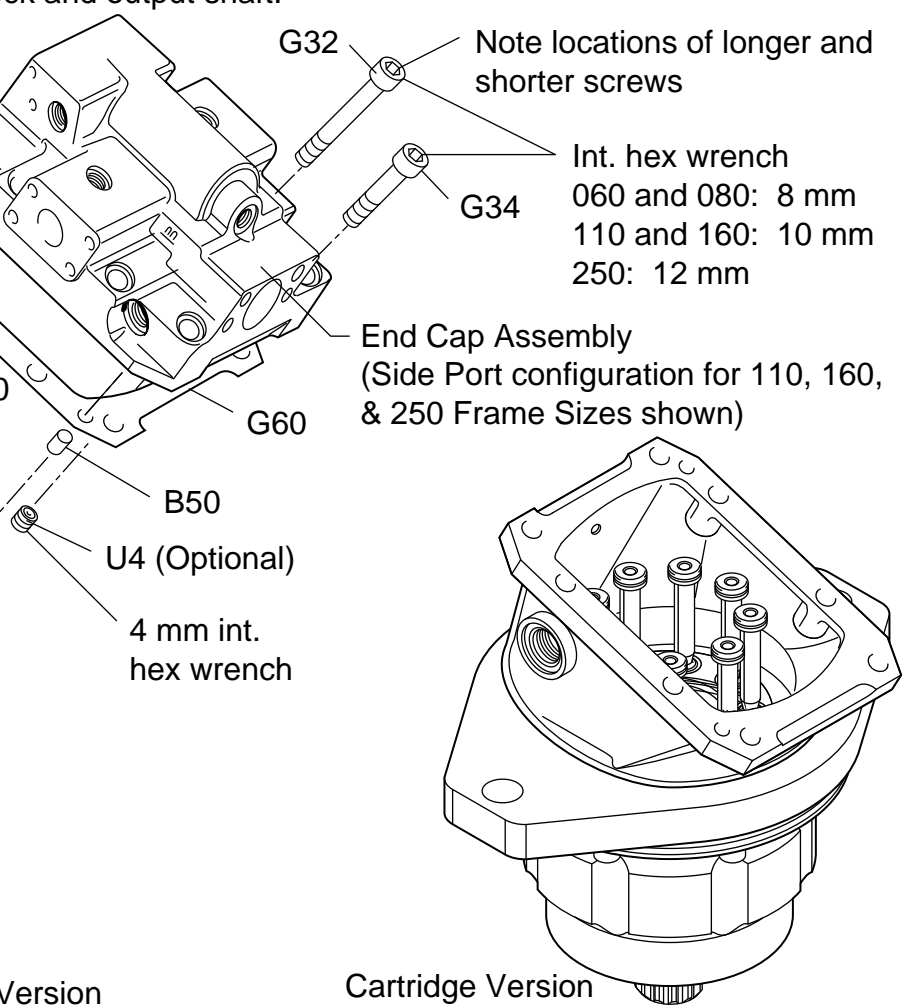
Note locations of longer and shorter screws

Int. hex wrench
060 and 080: 8 mm
110 and 160: 10 mm
250: 12 mm

End Cap Assembly
(Side Port configuration for 110, 160, & 250 Frame Sizes shown)



SAE Flange Version



Cartridge Version

Major Repair Instructions — Disassembly

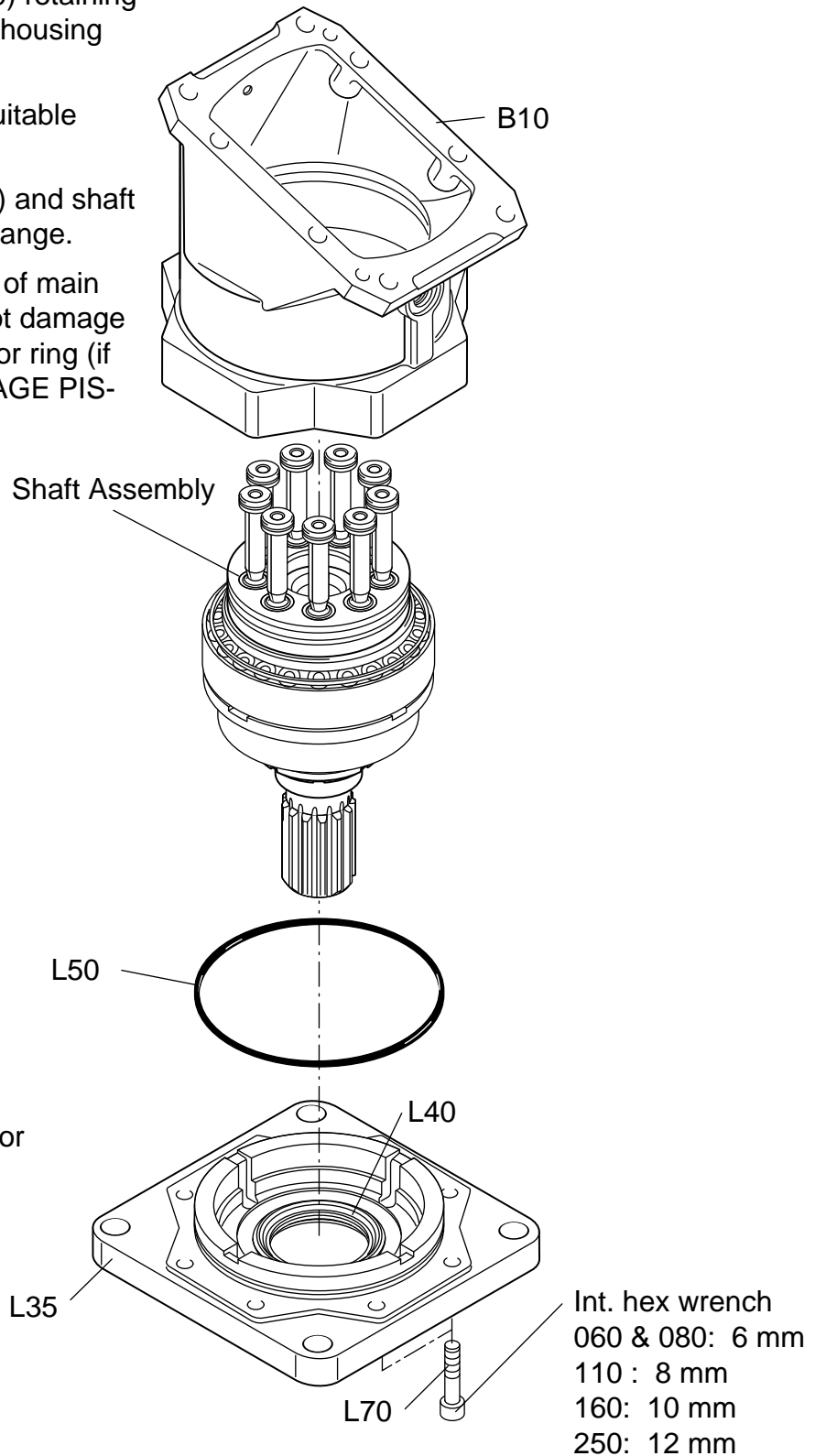
2A – SAE Flange Version

Remove screws (item L70) retaining flange (item L35) to main housing (item B10).

Remove flange using a suitable puller.

Remove O-ring (item L50) and shaft seal (item L40) from the flange.

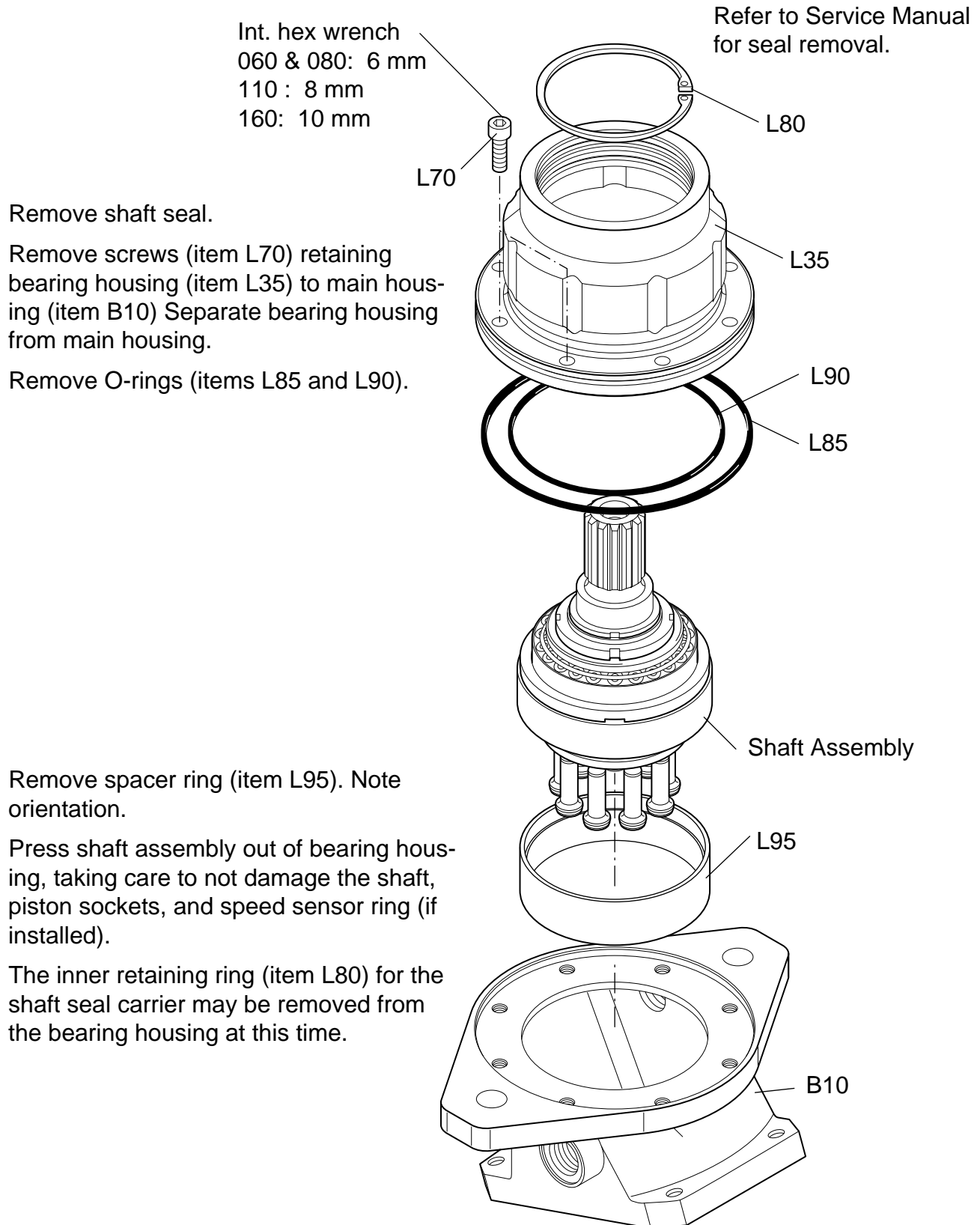
Press shaft assembly out of main housing, taking care to not damage the shaft and speed sensor ring (if installed). **DO NOT DAMAGE PISTON SOCKETS!**



Refer to Service Manual for seal removal.

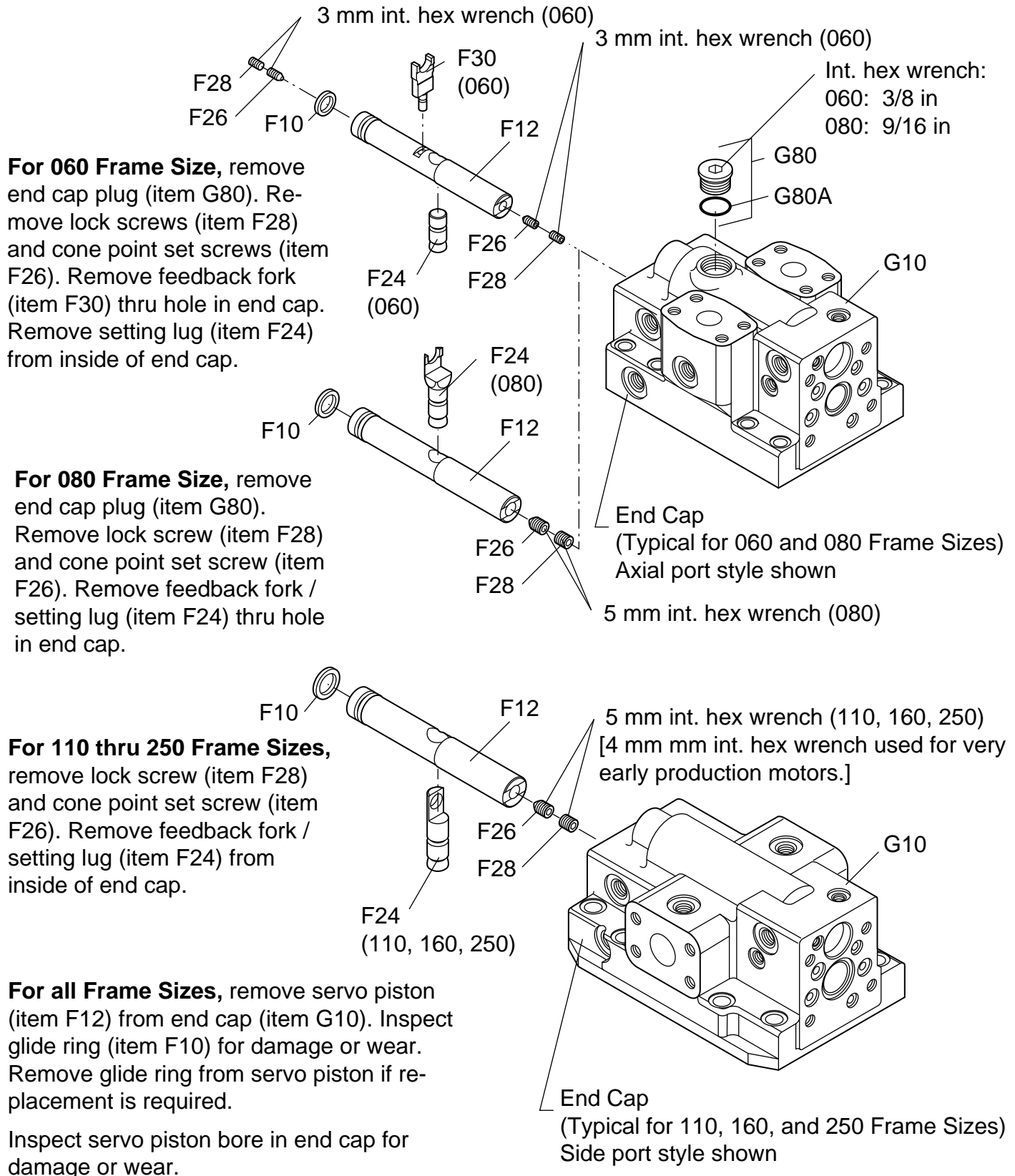
Major Repair Instructions — Disassembly

2B – Cartridge Version



Major Repair Instructions — Disassembly

3



Major Repair Instructions — Reconditioning and Replacement

1 – Shaft Assembly

The optional magnetic speed sensor ring (item W10) is pressed onto a machined surface of the output shaft flange. **DO NOT DAMAGE THE MAGNETIC SPEED SENSOR RING.**

Check the seal area of the shaft (item L110) and the output splines for damage or wear.

Inspect the synchronizing shaft insert (item L140) and the spring seat (item L120) for wear. The internal spring (item L130) must not be damaged. These parts are retained by three (3) hardened steel pins (item L150) pressed into blind holes in the synchronizing shaft insert, and are not individually serviceable.

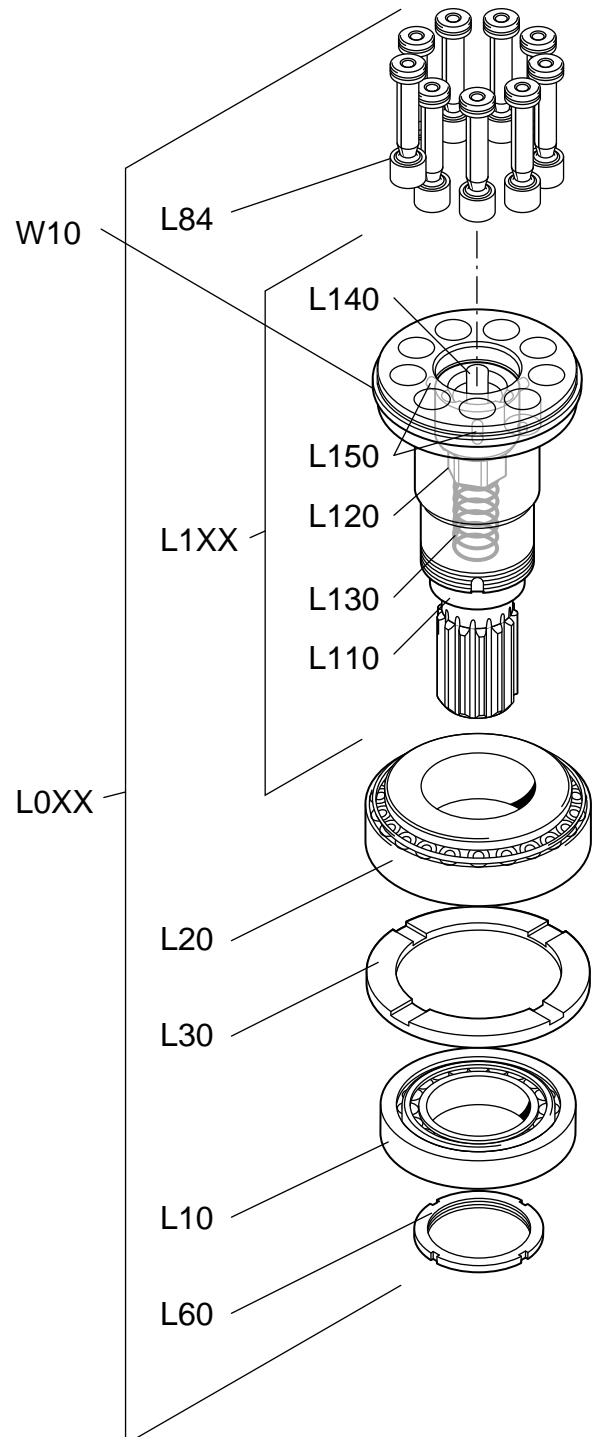
Inspect shaft bearings (items L10 and L20) for wear and roughness. Check that the bearing retaining nut (item L60) is firmly staked to the output shaft, and that no noticeable looseness is present in the bearings.

IF THE BEARING ADJUSTMENT FOR USED BEARINGS IS INCORRECT OR IF USED BEARINGS MUST BE REPLACED, A COMPLETE SHAFT ASSEMBLY (item L0XX) INCLUDING PISTONS AND NEW BEARINGS MUST BE INSTALLED.

Check the piston assemblies (Item L84) for damage or wear. It is normal for the piston balls to be tight in their sockets. The piston sockets are retained in the output shaft by an interference press fit.

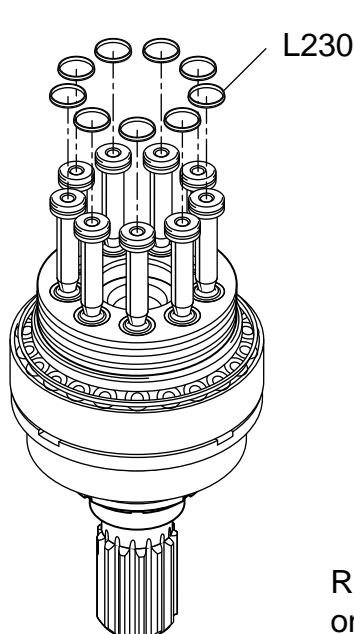
IF A PISTON (OR PISTONS) MUST BE REPLACED, A COMPLETE SHAFT ASSEMBLY (item L0XX) INCLUDING PISTONS AND NEW BEARINGS MUST BE INSTALLED.

The replacement output shaft assembly (item L0XX) includes pistons and bearings.



Major Repair Instructions — Reconditioning and Replacement

2 – Piston Rings



A small pair of retaining ring pliers may facilitate the removal of the piston rings (Item L230) from the pistons.

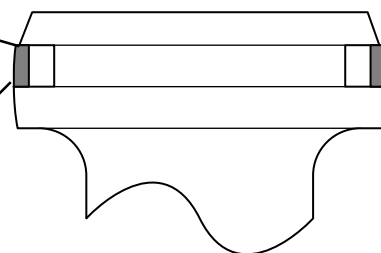
Install new piston rings onto the pistons.

WHEN INSTALLING NEW SPHERICAL PISTON RINGS, MAKE SURE THE SPHERICAL SURFACE CONFORMS TO THE SHAPE OF THE PISTON!

(A radial identification mark is provided on the "outer" side of the piston rings.)

The ends of each piston ring must NOT overlap each other.

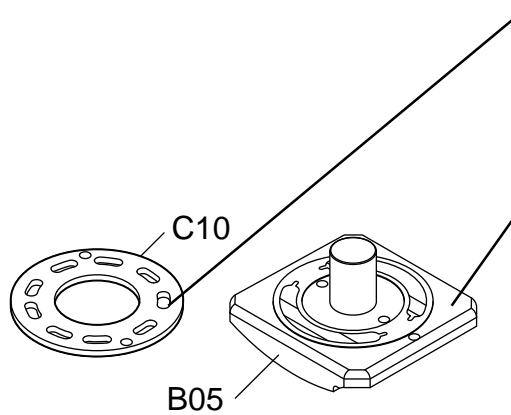
Radial identification mark located on this side of piston ring.



THE SPHERICAL SURFACE OF THE PISTON RING MUST CONFORM TO THE SPHERICAL SHAPE OF THE PISTON!

Major Repair Instructions — Reconditioning and Replacement

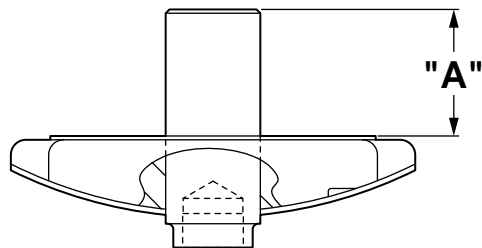
3 – Bearing Plate, Valve Segment, and Cylinder Block



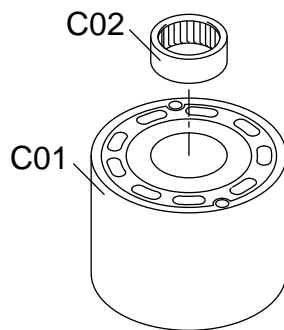
Inspect the running (bronze) surface of the bearing plate (item C10) for damage and excessive wear. The sealing surfaces must be free from scratches and nicks. The locating pin holes must not be worn. Replace the bearing plate if damaged or worn.

Inspect the valve segment (item B05) for damage or wear on the sealing surfaces. Inspect the spindle for wear.

Check that the spindle is located correctly in the valve segment by measuring Distance "A." If this dimension is not within the range shown in the accompanying chart, it indicates that the spindle has moved in the valve segment and the assembly must be replaced.



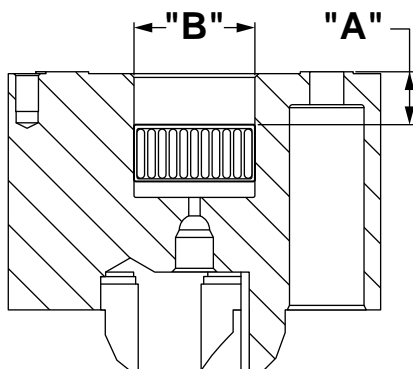
Frame size	Distance "A" mm [in]
060	27.5 to 27.7 [1.08 to 1.09]
080	32.6 to 32.8 [1.28 to 1.29]
110	34.5 to 34.7 [1.36 to 1.37]
160	39.4 to 39.6 [1.55 to 1.56]
250	44.2 to 44.4 [1.74 to 1.75]



Inspect the cylinder block assembly for wear or damage. The piston bores must be smooth. The bearing plate surface must be free from scratches or nicks, and the holes for the bearing plate locating pins must not be worn. The races for the synchronizing shaft rollers must not be worn.

Inspect the cylinder block bearing (item C02). If it requires replacement, remove the bearing using a suitable puller. **DO NOT DAMAGE THE BEARING PLATE SURFACE OF THE CYLINDER BLOCK!**

Press the new bearing into the cylinder block using a suitable press pin. Press the bearing into the cylinder block until it is located the proper distance below the bearing plate surface, as indicated by Distance "A" in the following table:

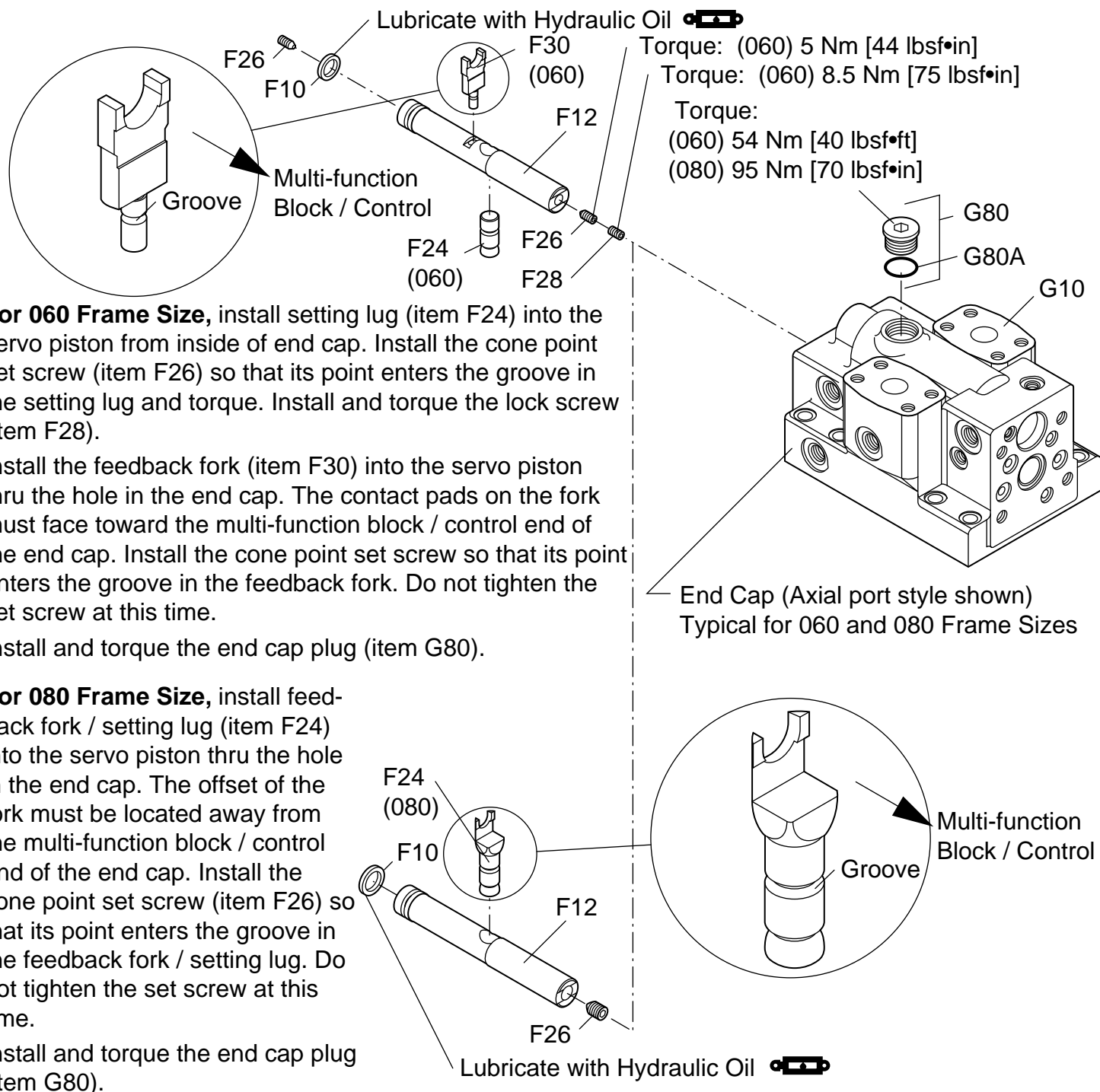


Frame size	Distance "A" mm [in]	Diameter "B" mm [in]
060	3.0 to 3.5 [0.12 to 0.14]	25.97 [1.022]
080	11.5 to 12.0 [0.45 to 0.47]	27.97 [1.101]
110	13.5 to 14.0 [0.53 to 0.55]	31.96 [1.258]
160	14.5 to 15.0 [0.57 to 0.59]	34.96 [1.376]
250	18.5 to 19.0 [0.73 to 0.75]	41.96 [1.652]

Major Repair Instructions — Assembly

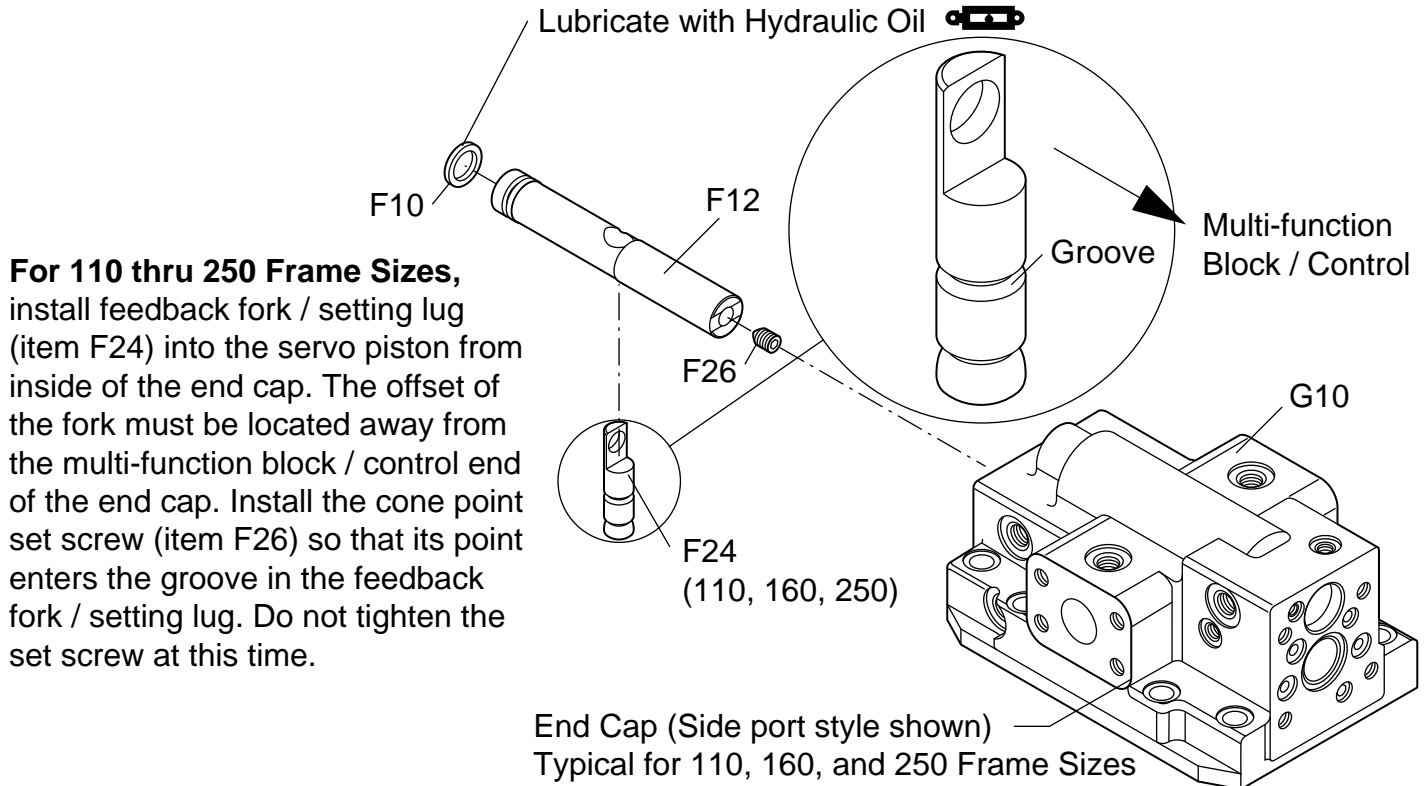
1

For all Frame Sizes, carefully install a new glide ring (item F10) on the servo piston (item F12). Lubricate the glide ring and install the servo piston into the end cap (item G10). The end of the servo piston with the glide ring is located opposite the multi-function block / control mounting surface of the end cap.



Major Repair Instructions — Assembly

2

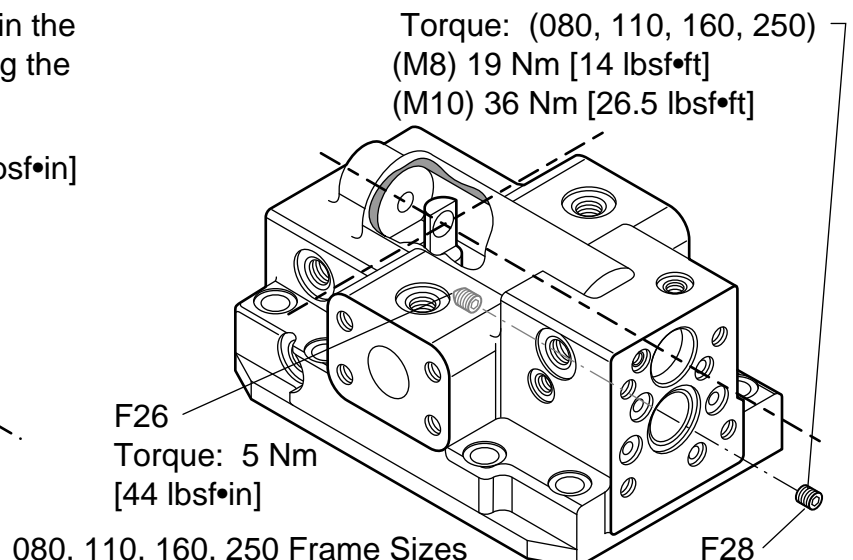
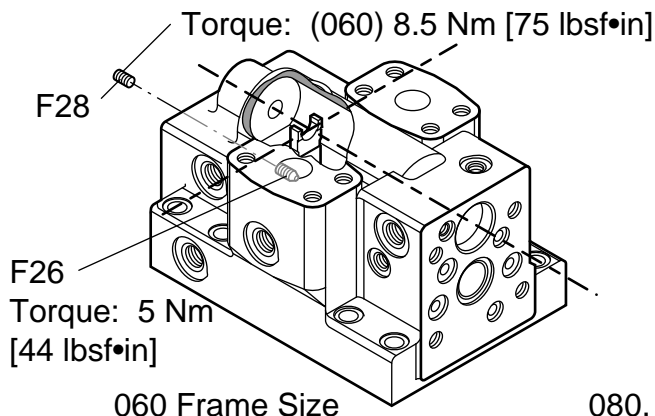


For all Frame Sizes, the feedback fork (060) or feedback fork / setting lug (080 thru 250) **MUST** be positioned perpendicular to the setting piston for proper control spring operation.

A 26.9 mm [1.06 in] diameter rod with the end machined perpendicular to its axis may be inserted through the valve sleeve bore in the end cap to align the fork while tightening the cone point set screw (item F26).

Torque the cone point set screw (item F26) to 5 Nm [44 lbf•in].

After torquing the cone point set screw, install and torque the lock screw (item F28).



Major Repair Instructions — Assembly

3A – SAE Flange Version

Support the main housing (item B10)
so the bearing bore is vertical.

Press shaft assembly into main
housing.

Install new O-ring (item L50) on
flange (item L35). Install new seal
(item L40) in flange.

Install flange assembly. **PROTECT
SEAL LIP FROM DAMAGE!**

Install and torque screws (item L70).

Torque:

060 & 080: 32 Nm (24 lbf•ft)

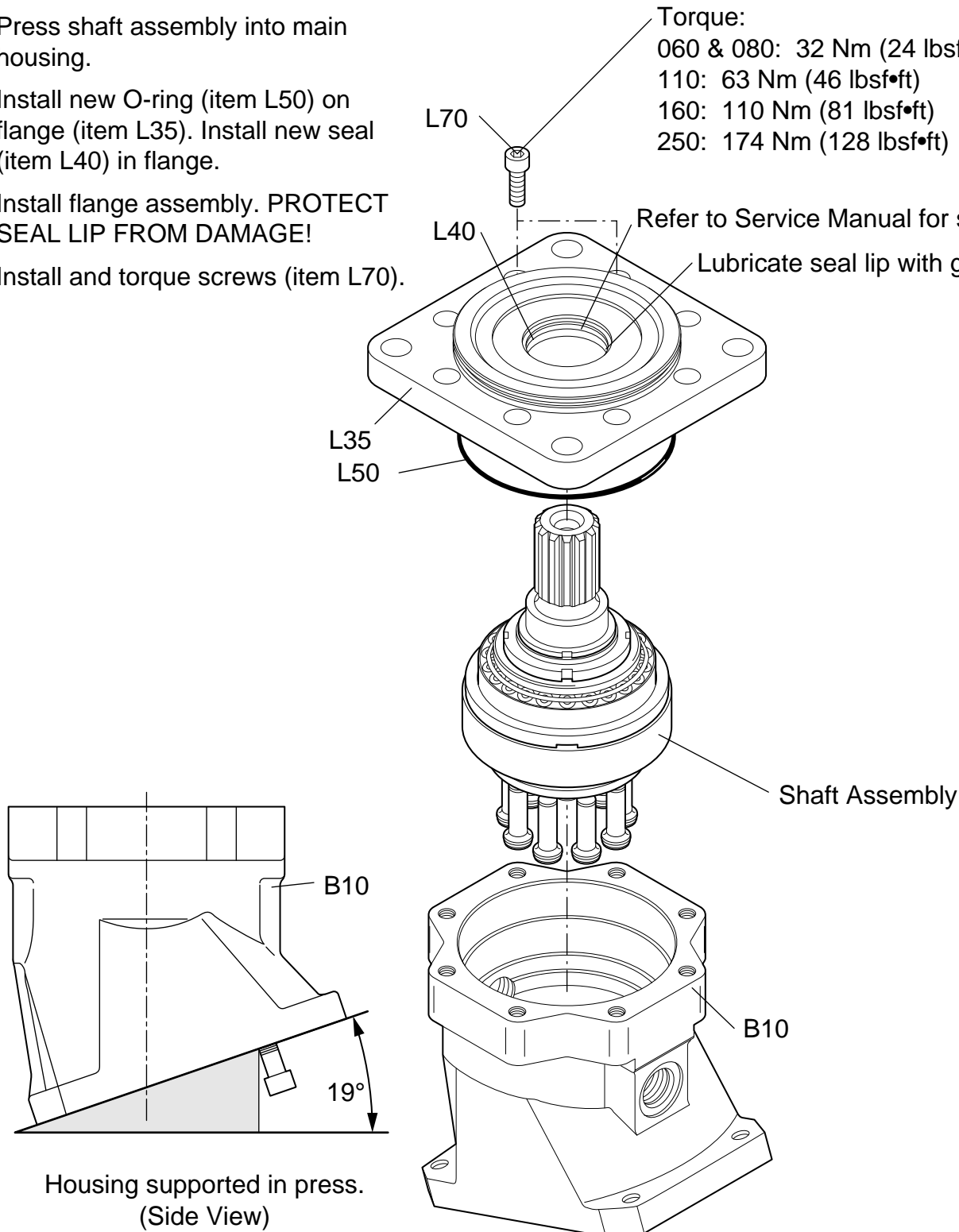
110: 63 Nm (46 lbf•ft)

160: 110 Nm (81 lbf•ft)

250: 174 Nm (128 lbf•ft)

Refer to Service Manual for seal installation.

Lubricate seal lip with grease. 



Major Repair Instructions — Assembly

3A – Cartridge Version

The inner retaining ring (item L80) for the shaft seal carrier may be installed in the bearing housing at this time.

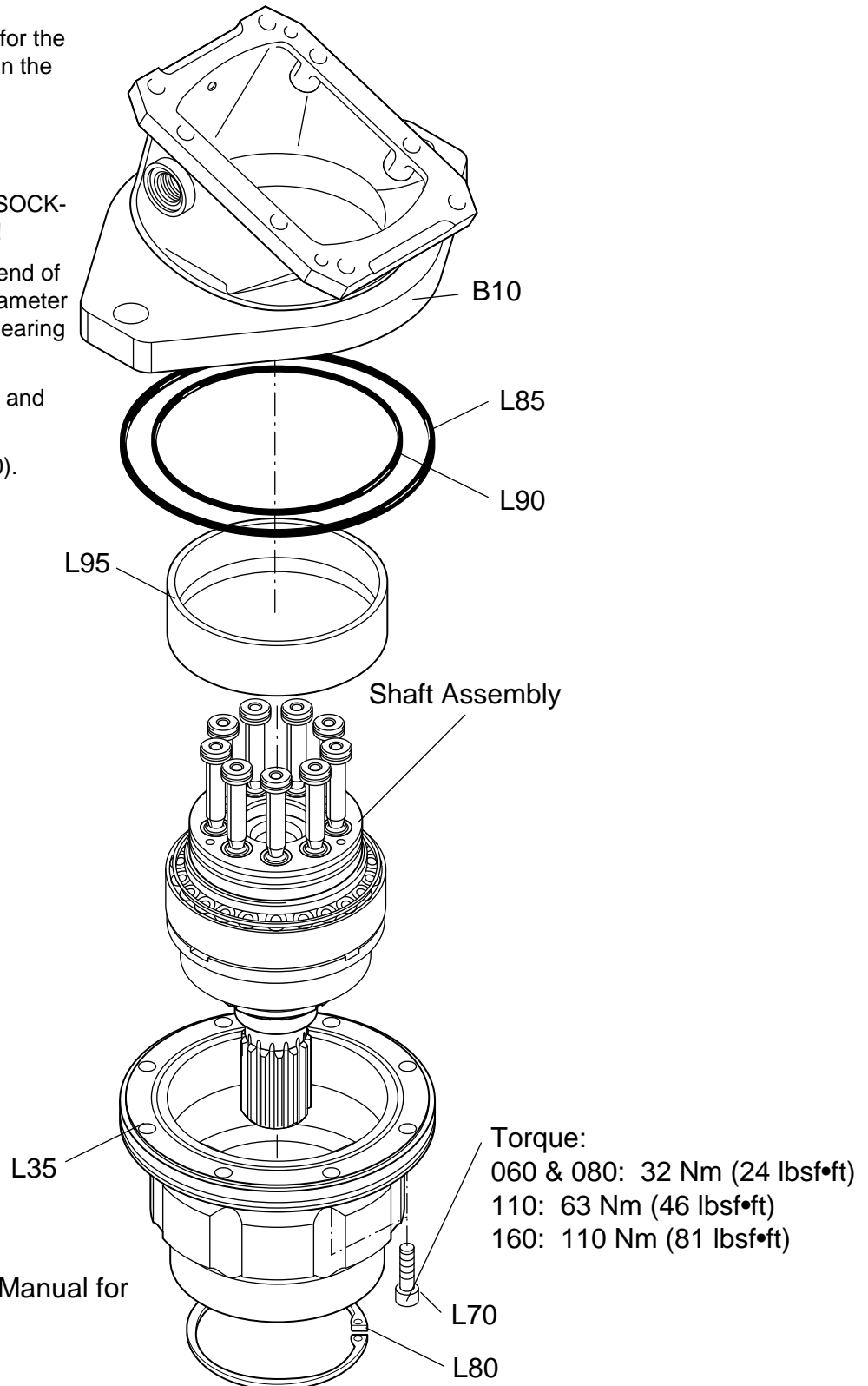
Press shaft assembly into bearing housing (item L35).

DO NOT DAMAGE THE PISTON SOCKETS OR SHAFT SEAL SURFACE!

Install spacer ring (item L95). The end of the spacer with the larger inside diameter is installed next to the inner shaft bearing cup.

Install O-rings (items L85 and L90) and install main housing (item B10).

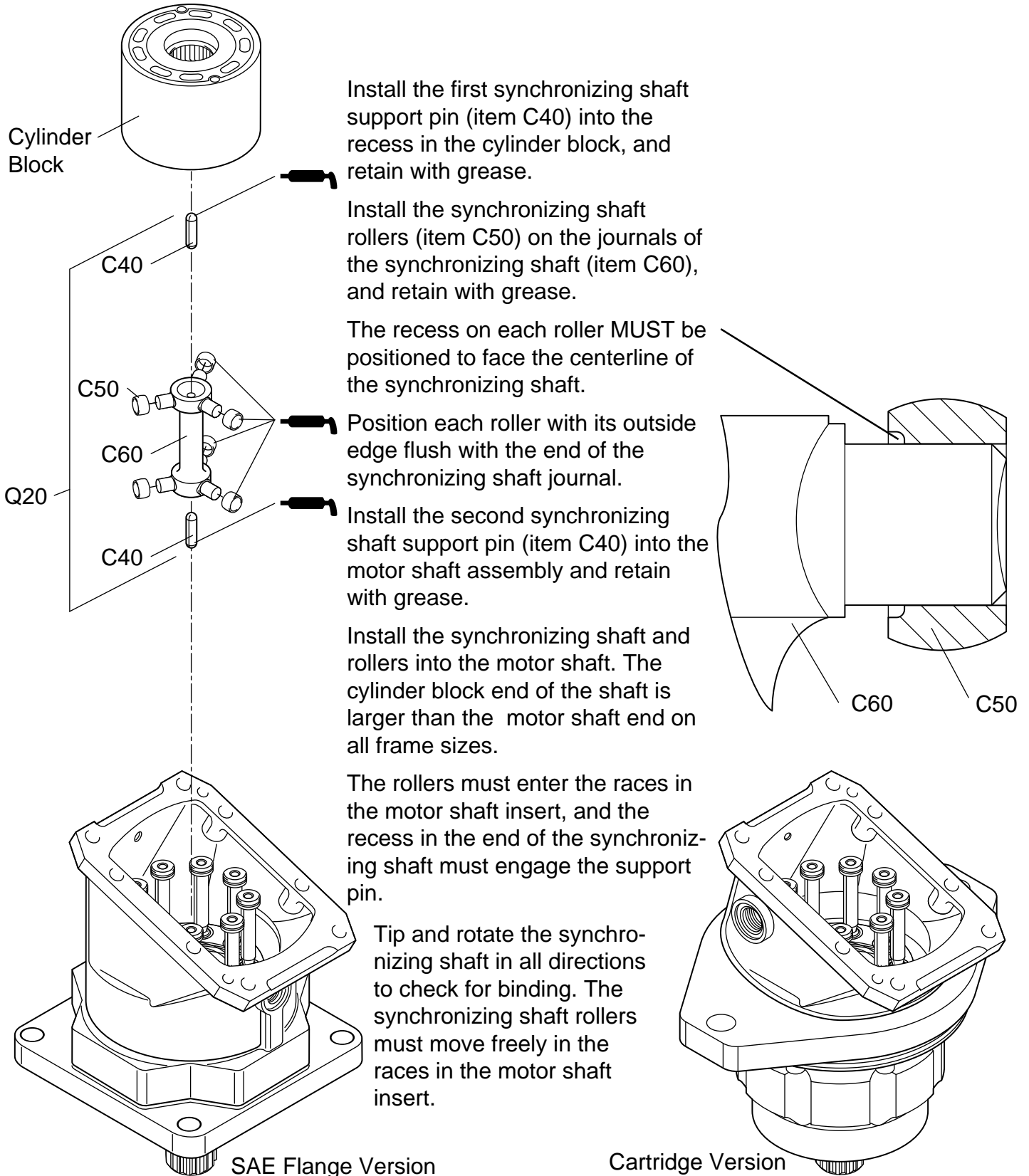
Install and torque screws (item L70).



Refer to Service Manual for seal installation.

Major Repair Instructions — Assembly

4



Major Repair Instructions — Assembly

5

Position the motor shaft in the housing as shown in the accompanying illustration. Tip the three (3) pistons closest to the minimum angle stop out, toward the housing.

With the synchronizing shaft supported in the motor shaft, install the cylinder block and its synchronizing shaft support pin (item C40) onto the pistons and synchronizing shaft. The cylinder block must be positioned so the synchronizing shaft rollers will enter their races in the block, while each piston enters its corresponding bore in the block.

A brass rod may be inserted through the cylinder block kidneys to guide the pistons into position. Start with the six (6) pistons closest to the "lowest" part of the end cap mounting surface.

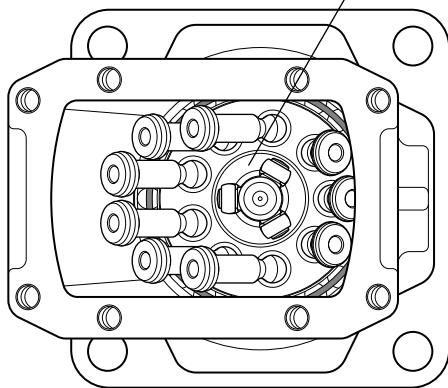
After the six (6) pistons enter their bores, tilt the cylinder block so the synchronizing shaft rollers (item C50) enter their races in the cylinder block, and the support pin enters its recess in the synchronizing shaft.

Lift the cylinder block slightly and guide the remaining three (3) pistons into their bores.

After the last piston is in position, check the position of the rollers closest to the minimum angle stop. Maintain an inward force on the cylinder block and carefully push it toward the "highest" part of the end cap mounting surface, and check that all of the synchronizing shaft rollers are in position.

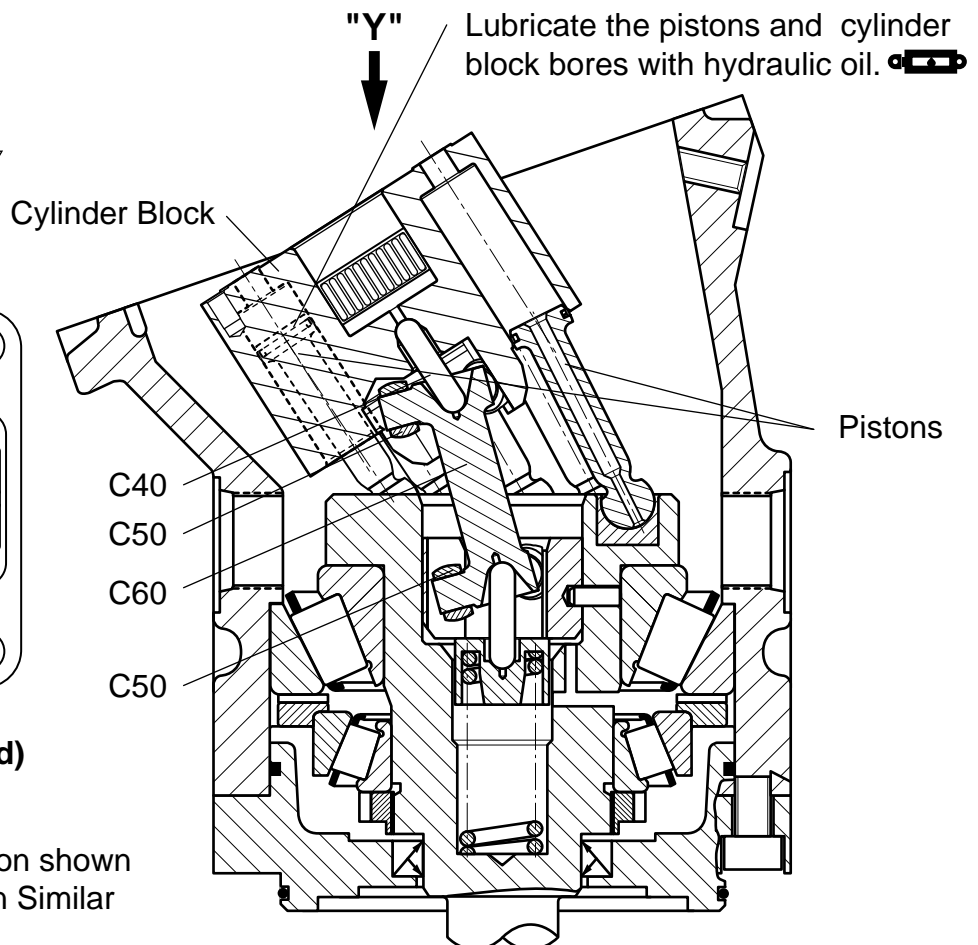
If the cylinder block is properly installed, there will be very little rotational free-play between the block and the motor shaft.

Position the motor shaft as shown prior to installing the cylinder block.



View in Direction "Y"
(Cylinder Block not installed)

SAE Flange Version shown
Cartridge Version Similar

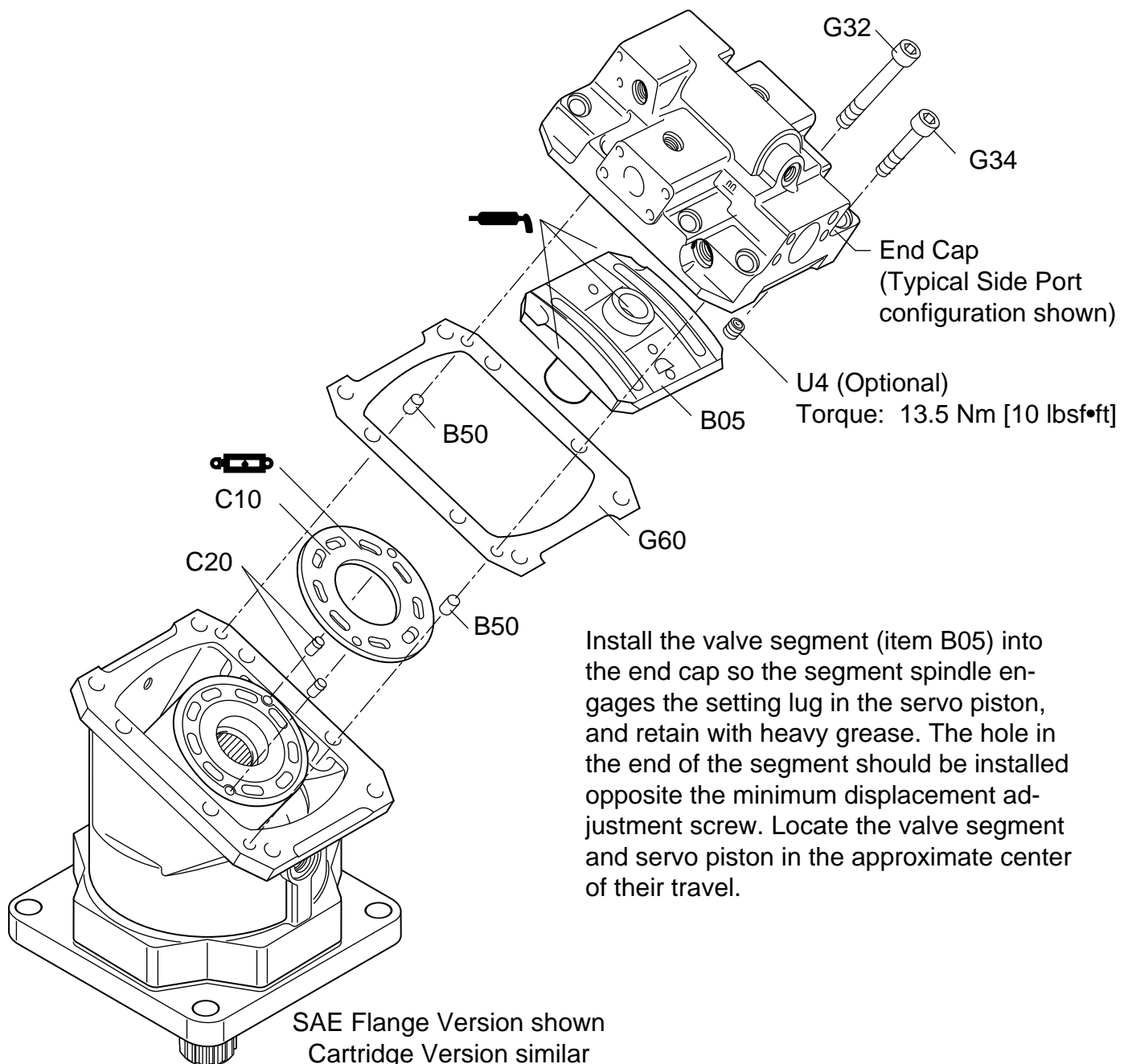


Major Repair Instructions — Assembly

6

Install the bearing plate locating pins (item C20) into the cylinder block. The longer end of each shouldered pin is installed into the block. Install the bearing plate (item C10) on the cylinder block, with its steel side facing toward the block. Lubricate the bronze side of the plate with hydraulic oil.

Install the end cap alignment pins (item B50) and gasket (item G60). Carefully locate the cylinder block in the approximate center of the housing opening. **DO NOT ALLOW THE PISTONS OR SYNCHRONIZING SHAFT ROLLERS TO FALL OUT OF POSITION!**



Major Repair Instructions — Assembly

7

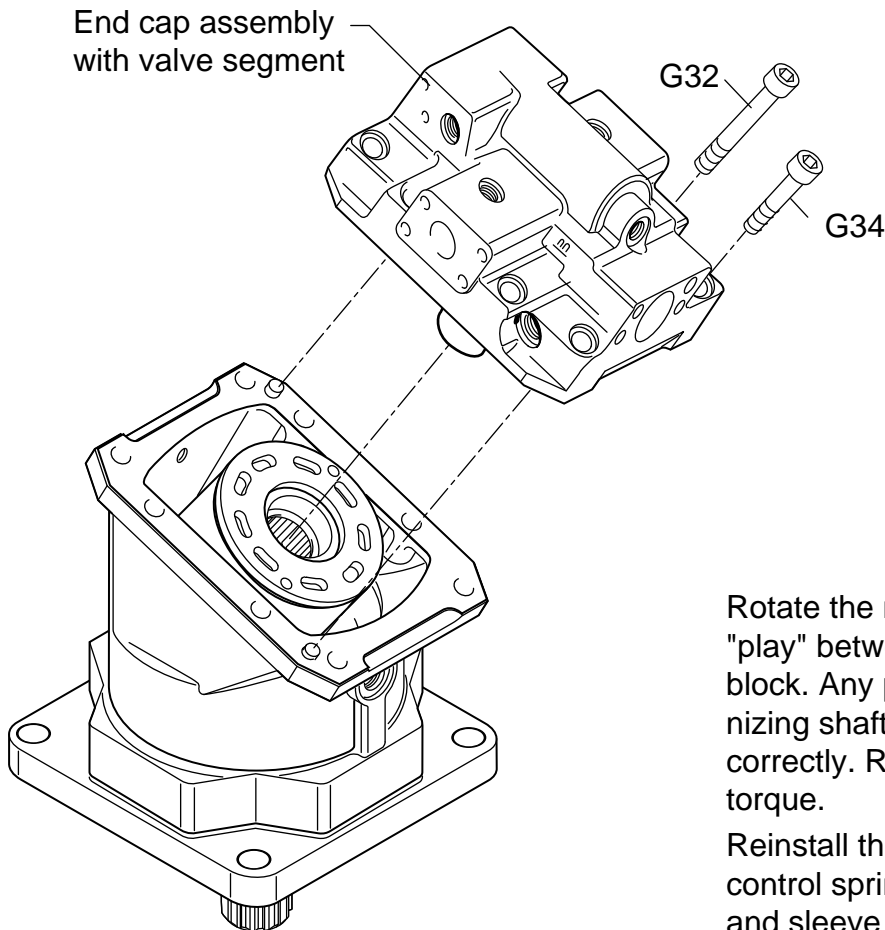
Install the end cap assembly and valve segment. The segment spindle must engage the bearing in the cylinder block. **DO NOT ALLOW THE PISTONS OR SYNCHRONIZING SHAFT ROLLERS TO FALL OUT OF POSITION!**

Install the screws (items G32 and G34) retaining the end cap assembly to the motor. The screws must be installed in their proper locations to ensure adequate thread engagement. The internal spring (in the motor shaft) should hold the end cap away from the housing a short distance.

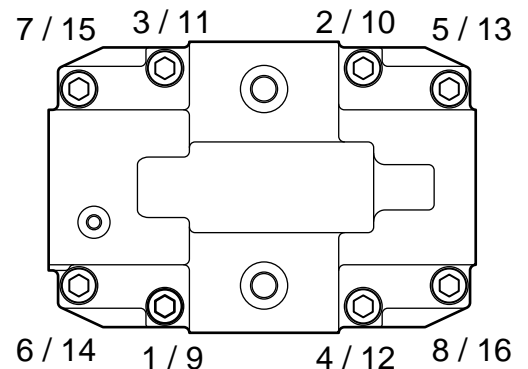
Tighten the screws by hand in a "double-X" pattern while rotating the motor shaft to ensure proper positioning of the synchronizing shaft rollers. **DO NOT FORCE THE END CAP INTO POSITION ON THE HOUSING!**

When the end cap is in position, torque the screws in a "double-X" pattern as indicated in the following table:

Frame size	Torque Nm [lbs•ft]
060	66 [49]
080	78 [58]
110	115 [85]
160	135 [100]
250	213 [157]



SAE Flange Version shown
Cartridge Version similar



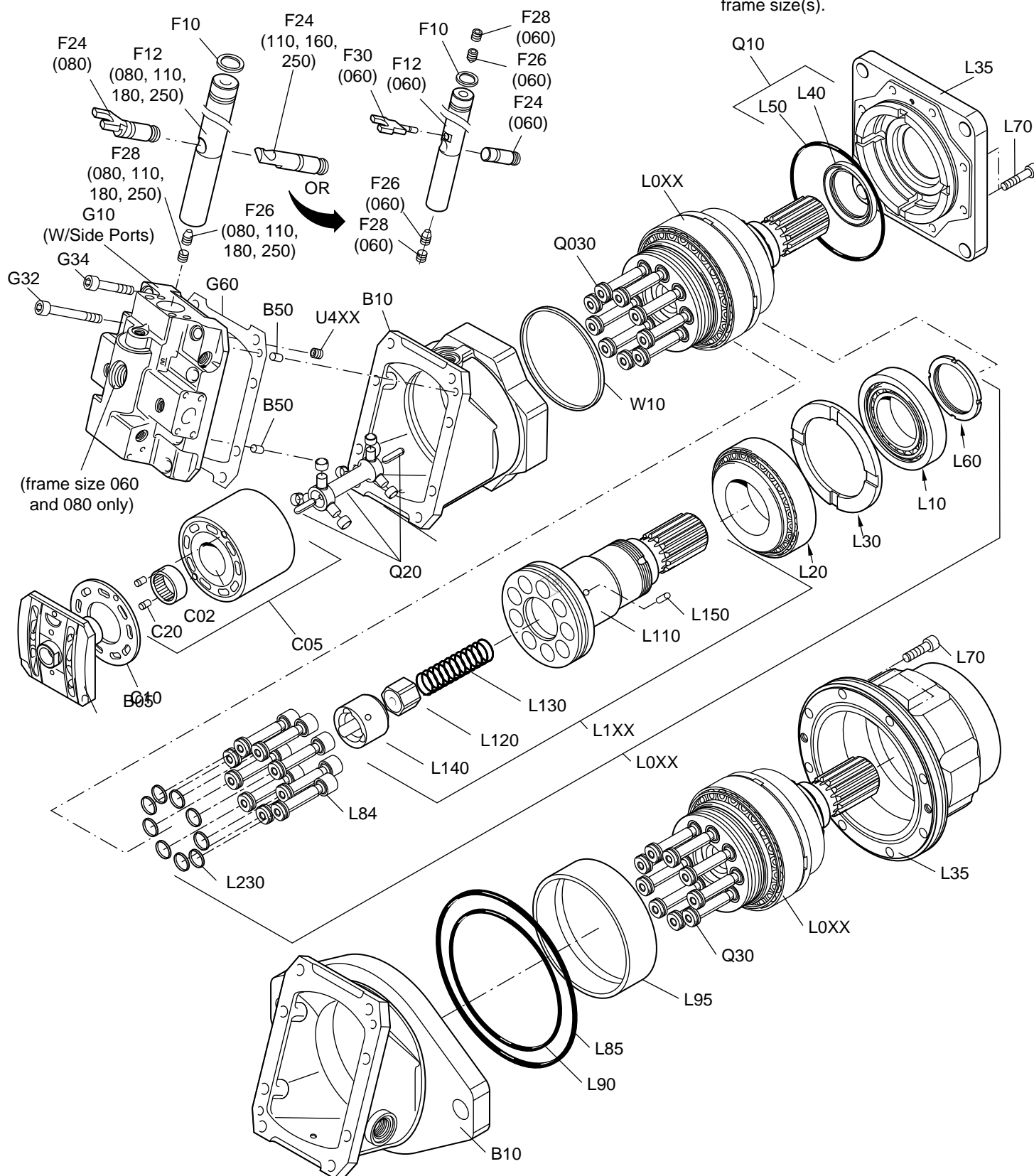
"Double-X" Pattern
Torquing Sequence
(110 Frame Size with
Side Port Endcap shown)

Rotate the motor shaft and check for "play" between the shaft and cylinder block. Any play indicates that the synchronizing shaft rollers are NOT installed correctly. Recheck the end cap screw torque.

Reinstall the minimum angle servo cover, control springs (if used), 4-way valve spool and sleeve (if used), and control and multi-function block (if used). Refer to the Series 51 Service Manual for details.

Major Repair Instructions — Exploded View

(....) = Applies to the indicated frame size(s).



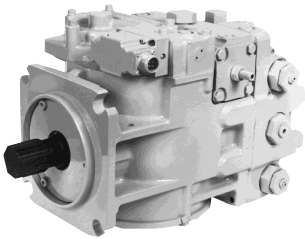
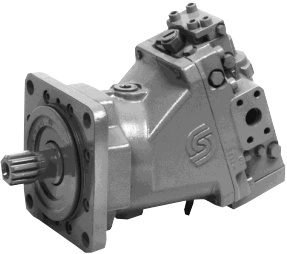

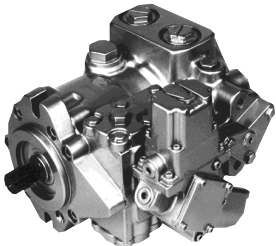
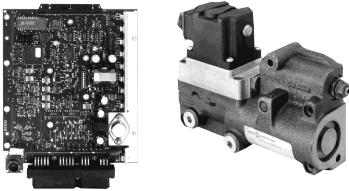
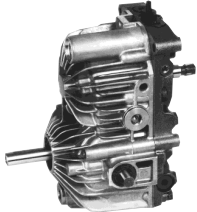
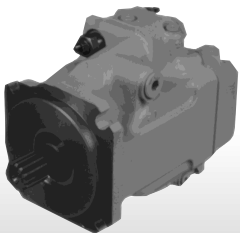
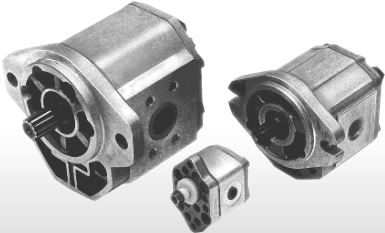

Hydraulic Power Systems

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